SHIKSHA CLASSES, BHANDARA

JEE 2023 (31 Jan 2023 shift 2)

Subject:- Chemistry, Physics, Mathematics

Time: 180 (in min)

Marks: 300

INSTRUCTIONS:-

Syllabus:-

Physics

-	Single Correct Answer Type

(1) A body of mass 10 kg is moving with an initial speed of 20 m/s. The body stops after 5 s due to friction between body and the floor. The value of the coefficient of friction is (Take acceleration due to gravity g = ms^{-2})

(1) 0.2

(2) 0.4

(3) 0.3

(4) 0.5

(2) A hypothetical gas expands adiabatically such that its volume changes from 08 litres to 27 litres. If the ratio of final pressure of the gas to initial pressure of the gas is $\frac{16}{81}$. Then the ratio of $\frac{C_p}{C_v}$ will be

(1) $\frac{4}{3}$

(2) $\frac{1}{2}$

(3) $\frac{3}{2}$

(4) $\frac{3}{1}$

(3) An alternating voltage source V = 260 sin (628t) is connected across a pure inductor of 5 mH. Inductive reactance in the circuit is

(1) 0.318 Ω

(2) 6.28 Ω

(3) 0.5 Ω

(4) 3.14 Ω

(4) Under the same load, wire A having length 5.0 m and cross-section 2.5 × 10^{-5} m^2 stretches uniformly by the same amount as another wire B of length 6.0 m and a cross-section of 3.0 × 10^{-5} m^2 stretches. The ratio of the Young's modulus of wire A to that of wire B will be

(1) 1 : 4

(2) 1 : 2

(3) 1 : 10

(4) 1 : 1

(5) Considering a group of positive charges, which of the following statements is correct?

(1) Net potential of the system cannot be zero at a point but net electric field can be zero at that point.

(2) Both the net potential and the net field can be zero at a point.

(3) Net potential of the system at a point can be zero but net electric field can't be zero at that point.

(4) Both the net potential and the net electric field cannot be zero at a point.

(6) A stone of mass 1 kg is tied to end of a massless string of length 1m. If the breaking tension of the string is 400 N, then maximum linear velocity, the stone can have without breaking the string, while rotating in horizontal plane, is:

(1) 40 ms^{-1}

(2) 10 ms^{-1}

(3) 20 ms^{-1}

(4) 400 ms^{-1}

(7) The number of turns of the coil of a moving coil galvanometer is increased in order to increase current sensitivity by 50%. The percentage change in voltage sensitivity of the galvanometer will be:

(1) 0%

(2) 100%

(3) 75%

(4) 50%

(8) Given below are two statements:

Statement I: In a typical transistor, all three regions emitter, base and collector have same doping level.

Statement II: In a transistor, collector is the thickest and base is the thinnest segment.

In the light of the above statements, choose the **most appropriate** answer from the options given below:

(1) **Statement I** is correct but **Statement II** is incorrect

(2) Both **Statement I** and **Statement II** are incorrect

(3) **Statement I** is incorrect but **Statement II** is correct

(4) Both **Statement I** and **Statement II** are correct

(9) The radius of electron's second stationary orbit in Bohr's atom is R. The radius of 3rd orbit will be

(1) $\frac{R}{3}$

(2) 2.25R

(3) 9R

(4) 3R

(10) A microscope is focused on an object at the bottom of a bucket. If liquid with refractive index $\frac{5}{3}$ is poured inside the bucket, then microscope have to be raised by 30 cm to focus the object again. The height of the liquid in the bucket is

(1) 12 cm

(2) 18 cm

(3) 75 cm

(4) 50 cm

(11) Match List I with List II:

	List I		List II
A.	Microwaves	I.	Physiotherapy
B.	UV rays	II.	Treatment of cancer
C.	Infra-red light	III.	Lasik eye surgery
D.	X-ray	IV.	Aircraft navigation

Choose the correct answer from the options given below:

(1) A-IV, B-I, C-II, D-III

(2) A-III, B-II, C-I, D-IV

(3) A-II, B-IV, C-III, D-I

(4) A-IV, B-III, C-I, D-II

(12) A body is moving with constant speed, in a circle of radius 10 m. The body completes one revolution in 4 s. At the end of 3rd second, the displacement of body (in m) from its starting point is:

(1) 30

(2) 15π

(3) 5π

(4) $10\sqrt{2}$

(13) If the two metals A and B are exposed to radiation of wavelength 350 nm. The work functions of metals A and B are 4.8 eV and 2.2 eV. Then choose the correct option.

(1) Metals B will not emit photo-electrons

(2) Both metals A and B will not emit photo-electrons

(3) Both metals A and B will emit photo-electrons

(4) Metals A will not emit photo-electrons

(14) A long conducting wire having a current I flowing through it, is bent into a circular coil of N turns. Then it is bent into a circular coil of n turns. The magnetic field is calculated at the centre of coils in both the cases. The ratio of the magnetic field in first case to that of second case is:

(1) $n^2 : N^2$

(2) $N : n$

(3) $N^2 : n^2$

(4) $n : N$

(15) A body weight W, is projected vertically upwards from earth's surface to reach a height above the earth which is equal to nine times the radius of earth. The weight of the body at that height will be:

(1) $\dfrac{W}{91}$

(2) $\dfrac{W}{3}$

(3) $\dfrac{W}{100}$

(4) $\dfrac{W}{9}$

(16) For a solid rod, the Young's modulus of elasticity is 3.2×10^{11} Nm^{-2} and density is 8×10^3 kg m^{-3}. The velocity of longitudinal wave in the rod will be

(1) 18.96×10^3 ms^{-1}

(2) 3.65×10^3 ms^{-1}

(3) 145.75×10^3 ms^{-1}

(4) 6.32×10^3 ms^{-1}

(17) Given below are two statements :

Statement I : For transmitting a signal, size of antenna (l) should be comparable to wavelength of signal (at least $l = \dfrac{\lambda}{4}$ in dimension)

Statement II : In amplitude modulation, amplitude of carrier wave remains constant (unchanged).

In the light of the above statements, choose the most appropriate answer from the options given below.

(1) Both Statement I and Statement II are correct

(2) Statement I is incorrect but Statement II is correct

(3) Both Statement I and Statement II are incorrect

(4) Statement I is correct but Statement II is incorrect

(18) The H amount of thermal energy is developed by a resistor in 10 s when a current of 4 A is passed through it. If the current is increased to 16 A, the thermal energy developed by the resistor in 10 s will be:

(1) H

(2) 16H

(3) 4H

(4) $\dfrac{H}{4}$

(19) Match List I with List II

	List I		List II
A.	Angular momentum	I.	$[ML^2T^{-2}]$
B.	Torque	II.	$[ML^{-2}T^{-2}]$
C.	Stress	III.	$[ML^2T^{-1}]$
D.	Pressure gradient	IV.	$[ML^{-1}T^{-2}]$

(1) A - I, B - IV, C - III, D - II

(2) A - II, B - III, C - IV, D - I

(3) A - IV, B- II, C - I, D - III

(4) A - III, B - I, C - IV, D - II

(20) Heat energy of 735 J is given to a diatomic gas allowing the gas to expand at constant pressure. Each gas molecule rotates around an internal axis but do not oscillate. The increase in the internal energy of the gas will be:

(1) 572 J

(2) 525 J

(3) 441 J

(4) 735 J

- Numerical value type

(21) The displacement equations of two interfering waves are given by $y_1 = 10\sin\left(\omega t + \dfrac{\pi}{3}\right)$ cm, $y_2 = 5\left[\sin\omega t + \sqrt{3}\cos\omega t\right]$ cm respectively. The amplitude of the resultant wave is _____ cm.

(22) A series LCR circuit consists of R = 80 Ω, X_L = 100 Ω, and X_C = 40 Ω. The input voltage is 2500 cos(100 πt) V. The amplitude of current, in the circuit, is _____ A.

(23) If the binding energy of ground state electron in a hydrogen atom is 13.6 eV, then, the energy required to remove the electron from the second excited state of Li^{2+} will be $x \times 10^{-1}$ eV. The value of x is _____.

(24) Two parallel plate capacitors C_1 and C_2 each having capacitance of 10 μF are individually charged by a 100 V D.C. source. Capacitor C_1 is kept connected to the source and a dielectric slab is inserted between it plates. Capacitor C_2 is disconnected from the source and then a dielectric slab is inserted in it. Afterwards the capacitor C_1 is also disconnected from the source and the two capacitors are finally connected in parallel combination. The common potential of the combination will be _____ V.

(Assuming Dielectric constant = 10)

(25) A ball is dropped from a height of 20 m. If the coefficient of restitution for the collision between ball and floor is 0.5, after hitting the floor, the ball rebounds to a height of _____ m.

(26) For the given circuit, in the steady state, $\left|V_B - V_D\right|$ = _____ V.
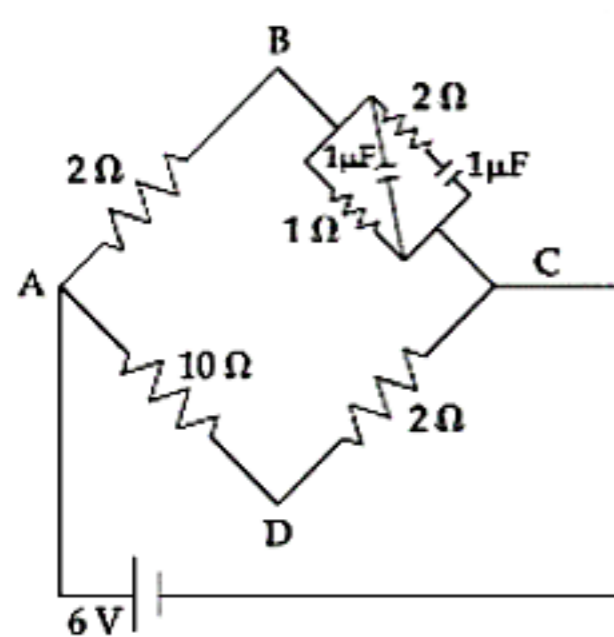
(27) A water heater of power 2000 W is used to heat water. The specific heat capacity of water is 4200 J kg^{-1} K^{-1}. The efficiency of heater is 70%. Time required to heat 2 kg of water from 10°C to 60°C is_____ s.

(Assume that the specific heat capacity of water remains constant over the temperature range of the water).

(28) Two bodies are projected from ground with same speeds 40 ms^{-1} at two different angles with respect to horizontal. The bodies were found to have same range. If one of the body was projected at an angle of 60°, with horizontal then sum of the maximum heights, attained by the two projectiles, is _____m. (Given g = 10 ms^{-2})

(29) Two discs of same mass and different radii are made of different materials such that their thickness are 1 cm and 0.5 cm respectively. The densities of materials are in the ratio 3 : 5. The moment of inertia of these discs respectively about their diameters will be in the ratio of $\dfrac{x}{6}$. The value of x is _____.

(30) Two light waves of wavelengths 800 and 600 nm are used in Young's double slit experiment to obtain interference fringes on a screen placed 7 m away from plane of slits. If the two slits are separated by 0.35 mm, then shortest distance from the central bright maximum to the point where the bright fringes of the two wavelength coincide will be _____ mm.

Chemistry

- Single Correct Answer Type

(31) Evaluate the following statements for their correctness.

A. The elevation in boiling point temperature of water will be same for 0.1 M NaCl and 0.1 M urea.

B. Azeotropic mixture boil without change in their composition.

C. Osmosis always takes place from hypertonic to hypotonic solution.

D. The density of 32% H_2SO_4 solution having molarity 4.09 M is approximately 1.26 g mL^{-1}.

E. A negatively charged sol is obtained when KI solution is added to silver nitrate solution.

Choose the correct answer from the options given below.

(1) A and C only

(2) B, D and E only

(3) A, B and D only

(4) B and D only

(32) When a hydrocarbon A undergoes complete combustion it require 11 equivalents of oxygen and produces 4 equivalents of water. What is the molecular formula of A?

(1) $C_{11}H_8$

(2) C_9H_8

(3) $C_{11}H_4$

(4) C_5H_8

(33) The Lewis acid character of boron tri halides follows the order

(1) $BBr_3 > BI_3 > BCl_3 > BF_3$

(2) $BCl_3 > BF_3 > BBr_3 > BI_3$

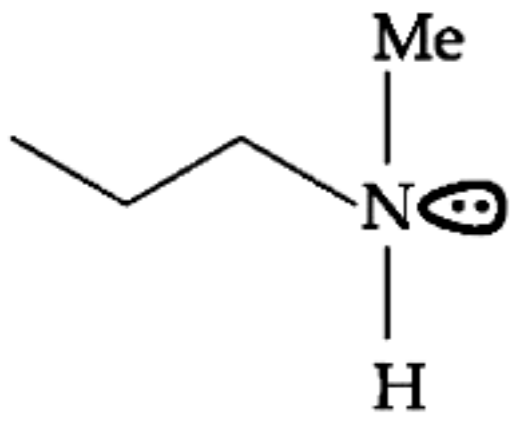(3) $BI_3 > BBr_3 > BCl_3 > BF_3$
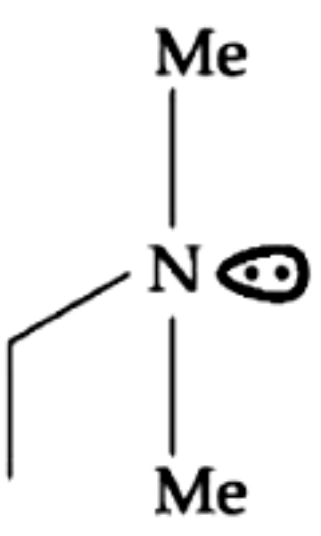
(4) $BF_3 > BCl_3 > BBr_3 > BI_3$

(34) A hydrocarbon 'X' with formula C_6H_8 uses two moles H_2 on catalytic hydrogenation of its one mole. On ozonolysis, 'X' yields two moles of methane dicarbaldehyde. The hydrocarbon 'X' is

(1) hexa –1, 3, 5–triene

(2) cyclohexa – 1, 3 – diene

(3) cyclohexa – 1, 4 – diene

(4) 1 – methylcyclopenta – 1, 4 – diene

(35) In the following halogenated organic compounds the one with maximum number of chlorine atoms in its structure is

(1) Chloropicrin

(2) Freon – 12

(3) Gammaxene

(4) Chloral

(36) An organic compound [A] ($C_4H_{11}N$), shows optical activity and gives N_2 gas on treatment with HNO_2. The compound [A] reacts with $PhSO_2Cl$ producing a compound which is soluble in KOH. The structure of A is :

(1)

(2)

(3)

(4)
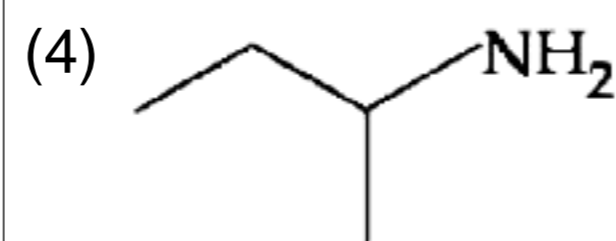
(37) Which of the following elements have half-filled f-orbitals in their ground state?

(Given : atomic number Sm = 62; Eu = 63; Tb = 65; Gd = 64, Pm = 61)

(A) Sm   (B) Eu

(C) Tb   (D) Gd

(E) Pm

Choose the **correct** answer from the options given below:

(1) A and E only

(2) B and D only

(3) C and D only

(4) A and B only

(38) Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A): The first ionization enthalpy of 3d series elements is more than that of group 2 metals.

Reason (R): In 3d series of elements successive filling of d-orbitals takes place.

In the light of the above statements, choose the **correct** answer from the options given below.

(1) **(A)** is true but **(R)** is false

(2) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**

(3) **(A)** is false but **(R)** is true

(4) Both **(A)** and **(R)** are true but **(R)** is **not** the correct explanation of **(A)**

(39) The element playing significant role in neuromuscular function and interneuronal transmission is

(1) Li

(2) Mg

(3) Ca

(4) Be
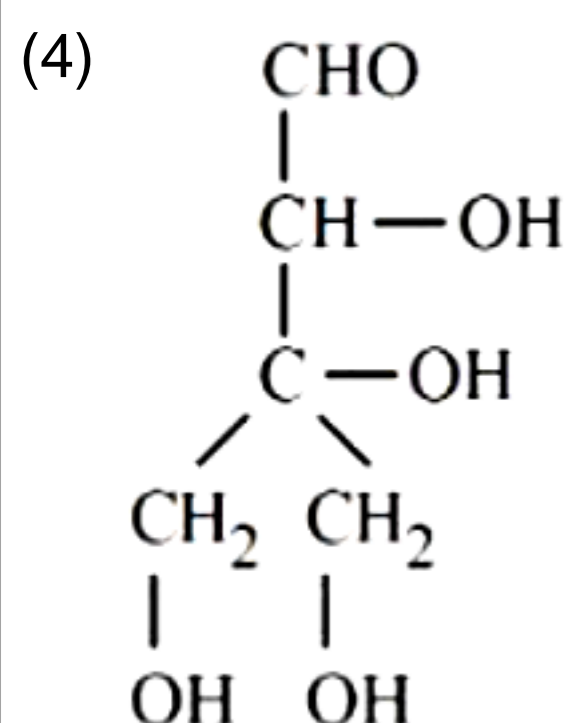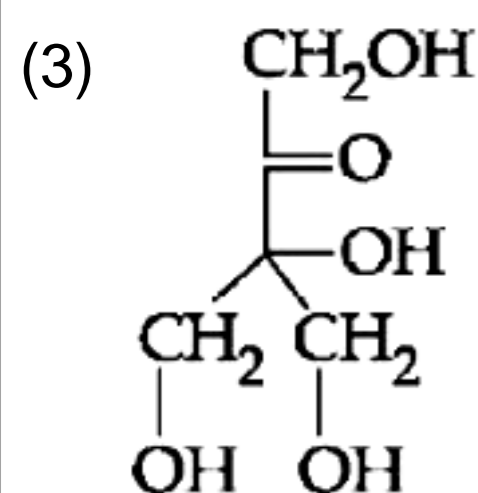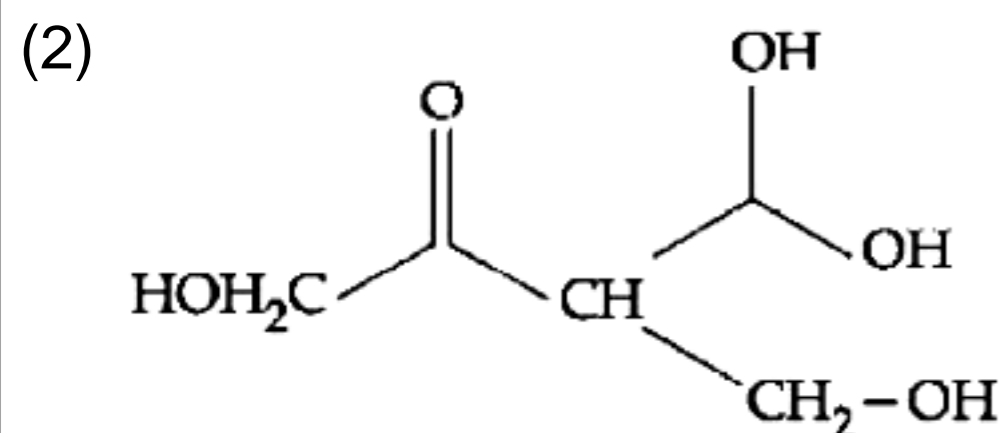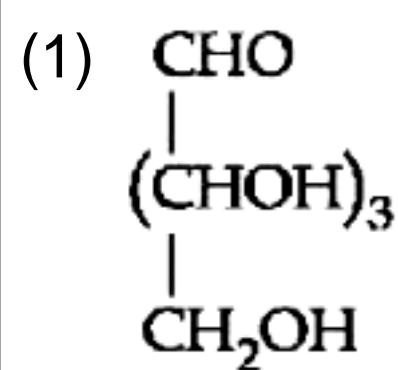
(40) Arrange the following orbitals in decreasing order of energy.

A.   n = 3, l = 0, m = 0

B.   n = 4, l = 0, m = 0

C.   n = 3, l = 1, m = 0

D.   n = 3, l = 2, m = 1

The correct option for the order is

(1) A > C > B > D

(2) B > D > C > A

(3) D > B > A > C

(4) D > B > C > A

(41) Compound A, $C_5H_{10}O_5$, given a tetraacetate with AC_2O and oxidation of A with $Br_2 - H_2O$ gives an acid, $C_5H_{10}O_6$. Reduction of A with HI gives isopentane. The possible structure of A is :

(1)
CHO
|
$(CHOH)_3$
|
CH_2OH

(2)

(3)
CH_2OH
|
$=O$
|
$—OH$
CH_2 CH_2
| |
OH   OH

(4)
CHO
|
CH—OH
|
C—OH
CH_2 CH_2
| |
OH   OH

(42) Which of the following compounds are not used as disinfectants?

(A) Chloroxylenol   (B) Bithional

(C) Veronal   (D) Prontosil

(E) Terpineol

Choose the **correct** answer from the options given below:

(1) A, B

(2) C, D

(3) A, B, E

(4) B, D, E

(43) Incorrect statement for the use of indicators in acid-base titration is :

(1) Phenolphthalein may be used for a strong acid vs strong base titration.

(2) Phenolphthalein is a suitable indicator for a weak acid vs strong base titration.

(3) Methyl orange may be used for a weak acid vs weak base titration.

(4) Methyl orange is a suitable indicator for a strong acid vs weak base titration.

(44) Given below are two statements

Statement I: H_2O_2 is used in the synthesis of Cephalosporin

Statement II: H_2O_2 is used for the restoration of aerobic conditions to sewage wastes.

In the light of the above statements, choose the **most appropriate** answer from the options given below

(1) **Statement I** is incorrect but **Statement II** is correct

(2) Both **Statement I** and **Statement II** are incorrect

(3) **Statement I** is correct but **Statement II** is incorrect

(4) Both **Statement I** and **Statement II** are correct

(45) The normal rain water is slightly acidic and its pH value is 5.6 because of which one of the following?

(1) $4NO_2 + O_2 + 2H_2O \rightarrow 4HNO_3$

(2) $CO_2 + H_2O \rightarrow H_2CO_3$

(3) $N_2O_5 + H_2O \rightarrow 2HNO_3$

(4) $2SO_2 + O_2 + 2H_2O \rightarrow 2H_2SO_4$

(46) Given below are two statements:

Statement I : Upon heating a borax bead dipped in cupric sulphate in a luminous flame, the colour of the bead becomes green.

Statement II: The green colour observed is due to the formation of copper(I) metaborate.

In the light of the above statements, choose the **most appropriate** answer from the options given below.

(1) **Statement I** is false but **Statement II** is true

(2) **Statement I** is true but **Statement II** is false

(3) Both **Statement I** and **Statement II** are false

(4) Both **Statement I** and **Statement II** are true

(47) Which one of the following statements is incorrect?

(1) Boron and Indium can be purified by zone refining method

(2) van Arkel method is used to purify tungsten

(3) The malleable iron is prepared from cast iron by oxidising impurities in a reverberatory furnace

(4) Cast iron is obtained by melting pig iron with scrap iron and coke using hot air blast

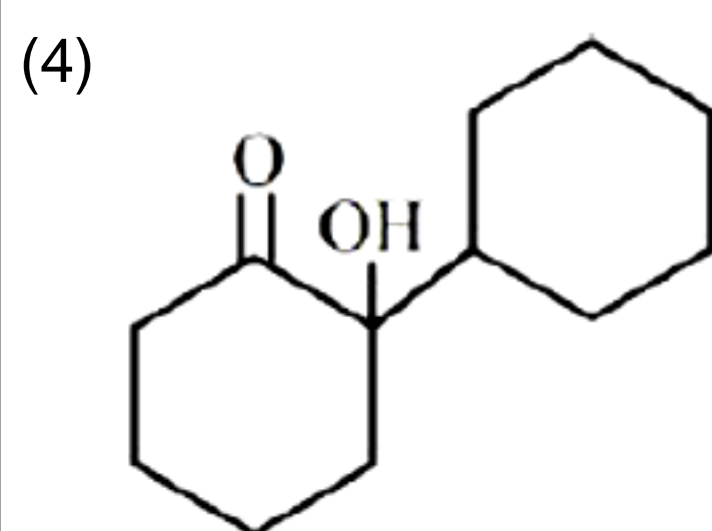(48) In Dumas method for the estimation of N_2, the sample is heated with copper oxide and the gas evolved is passed over
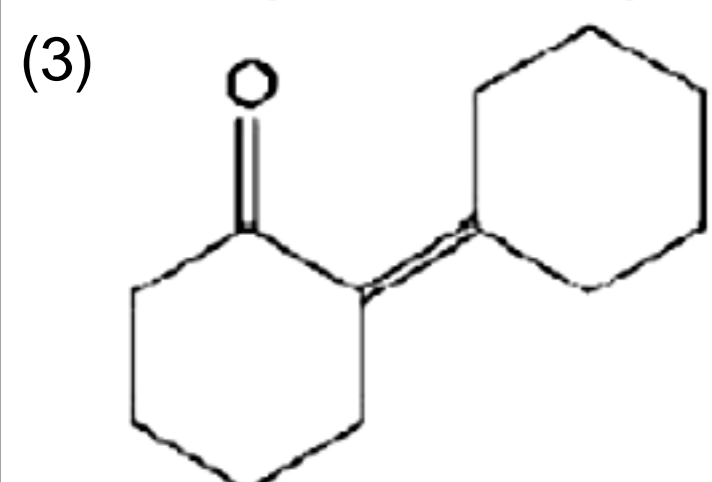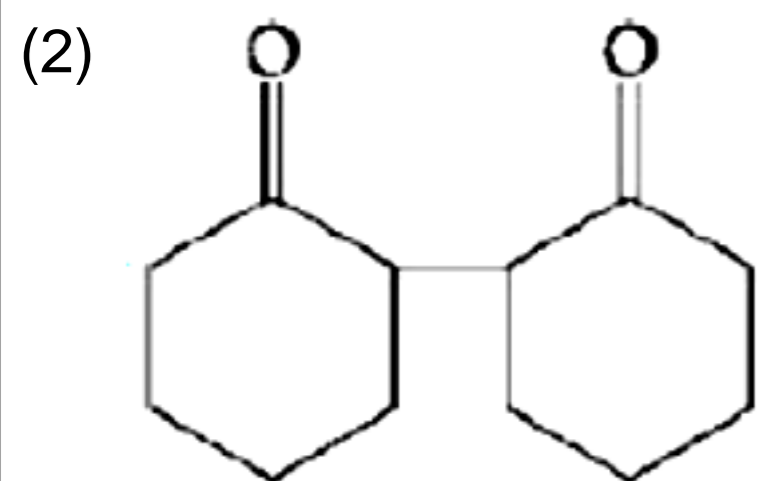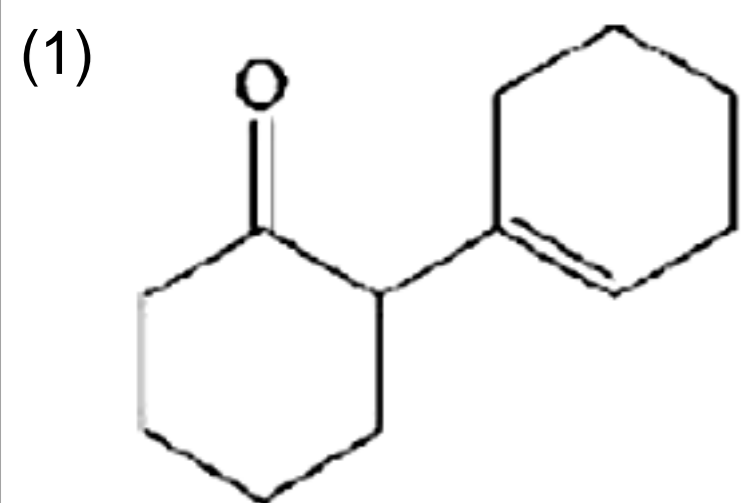
(1) Pd

(2) Copper gauze

(3) Ni

(4) Copper oxide

(49) Cyclohexylamine when treated with nitrous acid yields (P). On treating (P) with PCC results in (Q). When (Q) is heated with dil. NaOH we get (R). The final product (R) is

(1)

(2)

(3)

(4)

(50) Match **List I** with **List II**

	LIST-I		LIST-II
A.	Physisorption	I.	Single Layer Adsorption
B.	Chemisorption	II.	$20 - 40$ kJ mol^{-1}
C.	N$_2$(g) + 3H$_2$(g) $\xrightarrow{\text{Fe(s)}}$ 2NH$_3$(g)	III.	Chromatography
D.	Analytical Application or Adsorption	IV.	Heterogeneous catalysis

Choose the **correct** answer from the options given below

(1) A – II, B – I, C – IV, D – III

(2) A – IV, B – II, C – III, D – I

(3) A – II, B – III, C – I, D – IV

(4) A – III, B – IV, C – I, D – II

-    Numerical value type

(51) A sample of a metal oxide has formula $M_{0.83}O_{1.00}$. The metal M can exist in two oxidation states +2 and +3. In the sample of $M_{0.83}O_{1.00}$, the percentage of metal ions existing in +2 oxidation state is _____ %. (Nearest integer).

(52) The number of alkali metal(s), from Li, K, Cs, Rb having ionization enthalpy greater than 400 kJ mol^{-1} and forming stable superoxide is _____.

(53) The number of molecules which gives haloform test among the following molecules is _____.
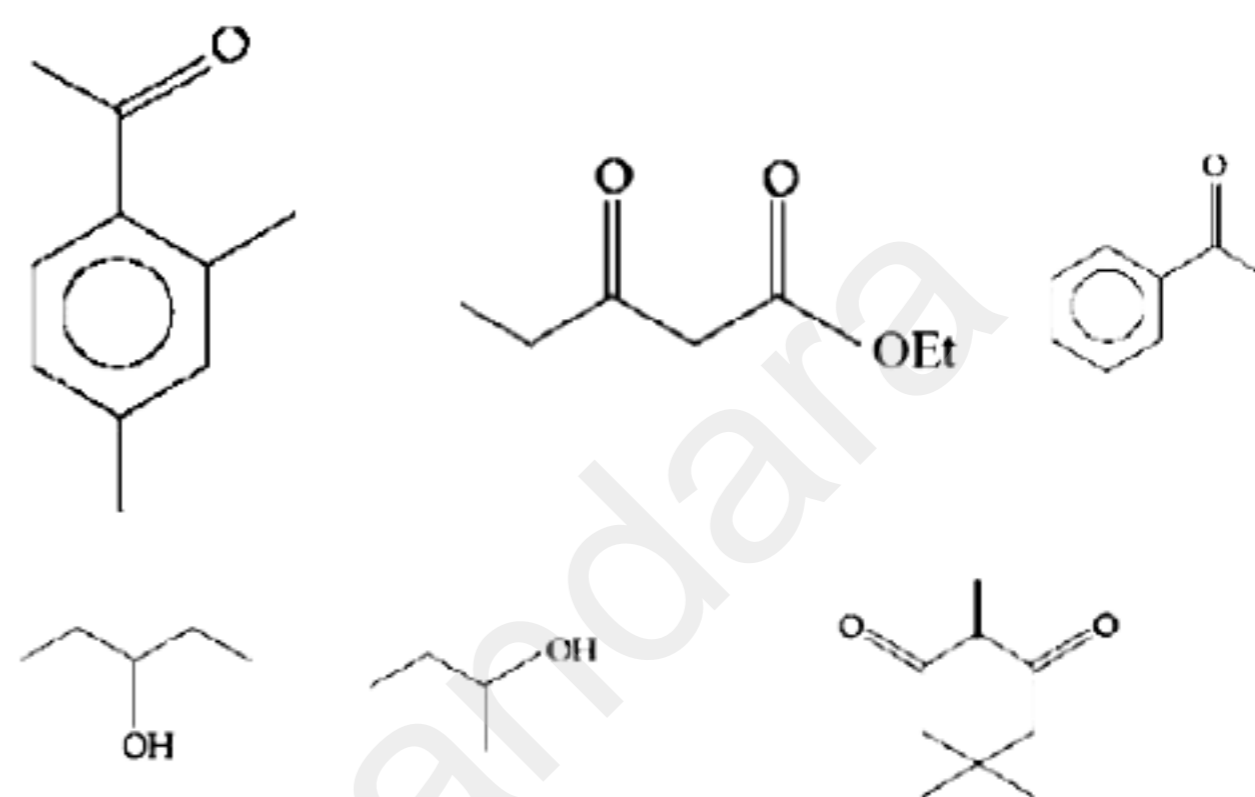
(54) Assume carbon burns according to following equation:

$$2C_{(s)} + O_{2(g)} \rightarrow 2CO(g)$$
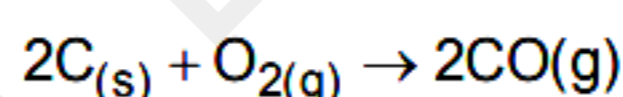
When 12 g carbon is burnt in 48 g of oxygen, the volume of carbon monoxide produced is _____ × 10^{-1} L at STP [nearest integer]

[Given : Assume CO as ideal gas, Mass of C is 12 g mol^{-1}, Mass of O is 16 g mol^{-1} and molar volume of an ideal gas at STP is 22.7 L mol^{-1})

$$2C(s) + O_2(g) \longrightarrow 2CO(g)$$
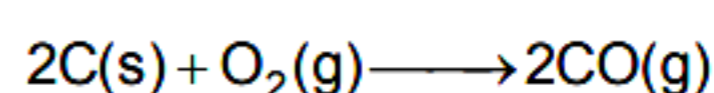
(55) If the CFSE of [Ti(H$_2$O)$_6$]$^{3+}$ is −96.0 kJ/mol, this complex will absorb maximum at wavelength _____ nm. (Nearest integer)

Assume Planck's constant (h) = 6.4 × 10^{-34} Js, Speed of light (c) = 3.0 × 10^8 m/s and Avogadro's Constant (N$_A$) = 6 × 10^{23}/mol.

(56) The rate constant for a first order reaction is 20 min^{-1}. The time required for the initial concentration of the reactant to reduce to its $\frac{1}{32}$ level is _____ × 10^{-2} min. (Nearest integer)

(Given: ln 10 = 2.303

         log 2 = 0.3010)

(57) The resistivity of a 0.8 M solution of an electrolyte is 5 × 10^{-3} Ω cm. Its molar conductivity is _____ × 10^4 Ω^{-1} cm^2 mol^{-1}. (Nearest integer)

(58) Amongst the following, the number of species having the linear shape is _____.

XeF$_2$, I$_3^+$, C$_3$O$_2$, I$_3^-$, CO$_2$, SO$_2$, BeCl$_2$ and BCl$_2^{\ominus}$
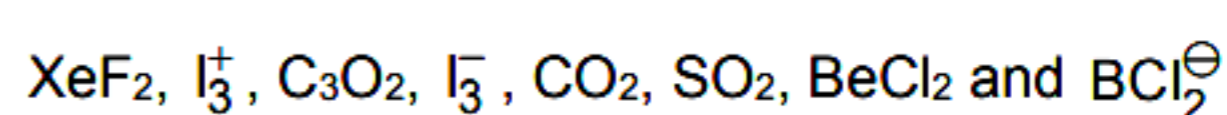
(59) Enthalpies of formation of $CCl_4(g)$, $H_2O(g)$, $CO_2(g)$ and $HCl(g)$ are -105, -242, -349 and -92 kJ mol^{-1} respectively. The magnitude of enthalpy of the reaction given below is _____ kJ mol^{-1}. (Nearest integer)

$$CCl_4(g) + 2H_2O(g) \rightarrow CO_2(g) + 4HCl(g)$$
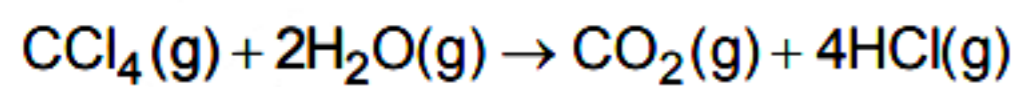
(60) At 298 K, the solubility of silver chloride in water is 1.434×10^{-3} g L^{-1}. The value of $-\log K_{sp}$ for silver chloride is _____.

(Given mass of Ag is 107.9 g mol^{-1} and mass of Cl is 35.5 g mol^{-1})

Mathematics

- Single Correct Answer Type

(61) The complex number $z = \dfrac{i-1}{\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}}$ is equal to :

(1) $\sqrt{2}\left(\cos\dfrac{5\pi}{12} + i\sin\dfrac{5\pi}{12}\right)$

(2) $\cos\dfrac{\pi}{12} - i\sin\dfrac{\pi}{12}$

(3) $\sqrt{2}\left(\cos\dfrac{\pi}{12} + i\sin\dfrac{\pi}{12}\right)$

(4) $\sqrt{2}\,i\left(\cos\dfrac{5\pi}{12} - i\sin\dfrac{5\pi}{12}\right)$

(62) Let the plane $P : 8x + a_1 y + a_2 z + 12 = 0$ be parallel to the line $L : \dfrac{x+2}{2} = \dfrac{y-3}{3} = \dfrac{z+4}{5}$. If the intercept of P on the y-axis is 1, then the distance between P and L is:

(1) $\sqrt{\dfrac{7}{2}}$

(2) $\dfrac{6}{\sqrt{14}}$

(3) $\sqrt{\dfrac{2}{7}}$

(4) $\sqrt{14}$

(63) Let H be the hyperbola, whose foci are $(1 \pm \sqrt{2}, 0)$ and eccentricity is $\sqrt{2}$. Then the length of its latus rectum is _____.

(1) 3

(2) $\dfrac{3}{2}$

(3) $\dfrac{5}{2}$

(4) 2

(64) If a point $P(\alpha, \beta, \gamma)$ satisfying

$$(\alpha\,\beta\,\gamma)\begin{pmatrix} 2 & 10 & 8 \\ 9 & 3 & 8 \\ 8 & 4 & 8 \end{pmatrix} = (0\ 0\ 0)$$

lies on the plane $2x + 4y + 3z = 5$, then $6\alpha + 9\beta + 7\gamma$ is equal to

(1) $\dfrac{11}{5}$

(2) 11

(3) $\dfrac{5}{4}$

(4) -1

(65) Let $\vec{a} - \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} - \hat{i} - \hat{j} + 2\hat{k}$ and $\vec{c} = 5\hat{i} - 3\hat{j} + 3\hat{k}$ be three vectors if $\vec{r}$ is a vector such that, $\vec{r} \times \vec{b} = \vec{c} \times \vec{b}$ and $\vec{r} \cdot \vec{a} = 0$, then $25|\vec{r}|^2$ is equal to

(1) 560

(2) 449

(3) 336

(4) 339

(66) $\lim\limits_{x \to \infty} \dfrac{\left(\sqrt{3x+1}+\sqrt{3x-1}\right)^6 + \left(\sqrt{3x+1}-\sqrt{3x-1}\right)^6}{\left(x+\sqrt{x^2-1}\right)^6 + \left(x-\sqrt{x^2-1}\right)^6} x^3$

(1) is equal to 9

(2) does not exist

(3) is equal to $\dfrac{27}{2}$

(4) is equal to 27

(67) The equation $e^{4x} + 8e^{3x} + 13e^{2x} - 8e^x + 1 = 0$, $x \in R$ has :

(1) two solutions and only one of them is negative

(2) two solutions and both are negative

(3) four solutions two of which are negative

(4) no solution

(68) Let P be the plane, passing through the point $(1, -1, -5)$ and perpendicular to the line joining the points $(4, 1, -3)$ and $(2, 4, 3)$. Then the distance of P from the point $(3, -2, 2)$ is

(1) 4

(2) 7

(3) 5

(4) 6

(69) The set of all values of a^2 for which the line $x + y = 0$ bisects two distinct chords drawn from a point $P\left(\dfrac{1+a}{2}, \dfrac{1-a}{2}\right)$ on the circle $2x^2 + 2y^2 - (1+a)x - (1-a)y = 0$ is equal to

(1) $(8, \infty)$

(2) $(4, \infty)$

(3) $(0, 4]$

(4) $(2, 12]$

(70) Among the relations

$S = \left\{ (a,b) : a,b \in \mathbb{R} - \{0\}, 2 + \dfrac{a}{b} > 0 \right\}$ and

$T = \left\{ (a,b) : a, b \in \mathbb{R}, a^2 - b^2 \in \mathbb{Z} \right\}$,

(1) S is transitive but T is not

(2) neither S nor T is transitive

(3) both S and T are symmetric

(4) T is symmetric but S is not

(71) The foot of perpendicular form the origin O to a plane P which meets the co-ordinate axes at the points A, B, C is (2, a, 4), a $\in$ N. If the volume of the tetrahedron OABC is 144 unit³, then which of the following points is **NOT** on P?

(1) (2, 2, 4)

(2) (3, 0, 4)

(3) (0, 6, 3)

(4) (0, 4, 4)

(72) Let $y = y(x)$ be the solution of the differential equation $(3y^2 - 5x^2)y\, dx + 2x(x^2 - y^2)dy = 0$ such that $y(1) = 1$. Then $|(y(2))^3 - 12y(2)|$ is equal to :

(1) $16\sqrt{2}$

(2) 32

(3) $32\sqrt{2}$

(4) 64

(73) Let $(a, b) \subset (0, 2\pi)$ be the largest interval for which $\sin^{-1}(\sin\theta) - \cos^{-1}(\sin\theta) > 0$, $\theta \in (0, 2\pi)$, holds. If $\alpha x^2 + \beta x + \sin^{-1}(x^2 - 6x + 10) + \cos^{-1}(x^2 - 6x + 10) = 0$ and $\alpha - \beta = b - a$, then α is equal to :

(1) $\dfrac{\pi}{16}$

(2) $\dfrac{\pi}{8}$

(3) $\dfrac{\pi}{48}$

(4) $\dfrac{\pi}{12}$

(74) The number of values of $r \in \{p, q, \sim p, \sim q\}$ for which $\left((p \wedge q) \Rightarrow (r \vee q) \right) \wedge \left((p \wedge r) \Rightarrow q \right)$ is a tautology, is

(1) 4

(2) 1

(3) 2

(4) 3

(75) Let the mean and standard deviation of marks of class A of 100 students be respectively 40 and α (>0), and the mean and standard deviation of marks of class B of n students be respectively 55 and $30 - \alpha$. If the mean and variance of the marks of the combined class of 100 + n students are respectively 50 and 350, then the sum of variances of classes A and B is :

(1) 450

(2) 650

(3) 900

(4) 500

(76) If $\phi(x) = \dfrac{1}{\sqrt{x}} \displaystyle\int_{\frac{\pi}{4}}^{x} (4\sqrt{2}\sin t - 3\phi'(t)dt,\ x > 0$, then

$\phi'\!\left(\dfrac{\pi}{4}\right)$ is equal to

(1) $\dfrac{8}{6 + \sqrt{\pi}}$

(2) $\dfrac{4}{6 + \sqrt{\pi}}$

(3) $\dfrac{4}{6 - \sqrt{\pi}}$

(4) $\dfrac{8}{\sqrt{\pi}}$

(77) Let a_1, a_2, a_3, ... be an A.P. If $a_7 = 3$, the product $a_1 a_4$ is minimum and the sum of its first n terms is zero, then $n! - 4a_n(n + 2)$ is equal to :

(1) $\dfrac{381}{4}$

(2) 24

(3) 9

(4) $\dfrac{33}{4}$

(78) The absolute minimum value, of the function $f(x) = |\,x^2 - x + 1| + [x^2 - x + 1]$, where [t] denotes the greatest integer function, in the interval [−1. 2], is

(1) $\dfrac{3}{4}$

(2) $\dfrac{3}{2}$

(3) $\dfrac{1}{4}$

(4) $\dfrac{5}{4}$

(79) Let $\alpha > 0$. If $\displaystyle\int_{0}^{\alpha} \dfrac{x}{\sqrt{x + \alpha} - \sqrt{x}}dx = \dfrac{16 + 20\sqrt{2}}{15}$, then α is equal to:

(1) 2

(2) 4

(3) $\sqrt{2}$

(4) $2\sqrt{2}$

(80) Let $f : \mathbb{R} - \{2,6\} \to \mathbb{R}$ be real valued function defined as $f(x) = \dfrac{x^2 + 2x + 1}{x^2 - 8x + 12}$. Then range of f is

(1) $\left(-\infty, -\dfrac{21}{4}\right] \cup [0, \infty)$

(2) $\left(-\infty, -\dfrac{21}{4}\right) \cup (0, \infty)$

(3) $\left(-\infty, -\dfrac{21}{4}\right] \cup [1, \infty)$

(4) $\left(-\infty, -\dfrac{21}{4}\right] \cup \left[\dfrac{21}{4}, \infty\right)$

- Numerical value type

(81) Let A be the event that the absolute difference between two randomly chosen real numbers in the sample space [0, 60] is less than or equal to a. If $P(A) = \dfrac{11}{36}$, then a is equal to _____.

(82) Let the area of the region $\left\{(x,y) : |2x - 1| \le y \le |x^2 - x|, 0 \le x \le 1\right\}$ be A. Then $(6A + 11)^2$ is equal to _____.

(83) Let $A = \left[a_{ij}\right]$, $a_{ij} \in \mathbb{Z} \cap [0,4], 1 \le i, j \le 2$. The number of matrices A such that the sum of all entries is a prime number $p \in (2,13)$ is _____.

(84) The coefficient of x^{-6}, in the expansion of $\left(\dfrac{4x}{5} + \dfrac{5}{2x^2}\right)^9$, is _____.

(85) Let A be a $n \times n$ matrix such that $|A| = 2$. If the determinant of the matrix $\text{Adj}(2 \cdot \text{Adj}(2A^{-1})) \cdot$ is 2^{84}, then n is equal to _____.

(86) Let $\vec{a}, \vec{b}, \vec{c}$ be three vectors such that $|\vec{a}| = \sqrt{31}$, $4|\vec{b}| = |\vec{c}| = 2$ and $2(\vec{a} \times \vec{b}) = 3(\vec{c} \times \vec{a})$. If the angle between $\vec{b}$ and $\vec{c}$ is $\dfrac{2\pi}{3}$, then $\left(\dfrac{\vec{a} \times \vec{c}}{\vec{a} \cdot \vec{b}}\right)^2$ is equal to _____.

(87) The sum $1^2 - 2 \cdot 3^2 + 3 \cdot 5^2 - 4 \cdot 7^2 + 5 \cdot 9^2 - \ldots + 15 \cdot 29^2$ is _____.

(88) If the constant term in the binomial expansion of $\left(\dfrac{x^{\frac{5}{2}}}{2} - \dfrac{4}{x^l}\right)^9$ is -84 and the coefficient of x^{-3l} is $2^\alpha \beta$, where $\beta < 0$ is an odd number, then $|\alpha l - \beta|$ is equal to _____.

(89) Let S be the set of all $a \in \mathbb{N}$ such that the area of the triangle formed by the tangent at the point $P(b, c)$, b, $c \in \mathbb{N}$, on the parabola $y^2 = 2ax$ the lines $x = b$, $y = 0$ is 16 unit^2, then $\displaystyle\sum_{a \in S} a$ is equal to _____.

(90) If $^{2n+1}P_{n-1} : ^{2n-1}P_n = 11 : 21$, then $n^2 + n + 15$ is equal to

Answer Key

Physics

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	1	4	4	1	3	1	3	2	3	4	4	4	3	3

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
4	4	2	4	2	20.0	25.0	136.0	55.0	5.0	1.0	300.0	80.0	5.0	48.0

Chemistry

31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
4	2	3	3	3	4	2	2	3	4	4	2	3	4	2

46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
3	2	2	3	1	59.0	2.0	3.0	227.0	480.0	17.0	25.0	5.0	173.0	10.0

Mathematics

61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
1	4	4	2	4	3	2	3	1	4	2	3	4	3	4

76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
1	2	1	3	1	10.0	125.0	204.0	5040.0	5.0	3.0	6592.0	98.0	146.0	45.0

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